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INTERNAL TECHNICAL REPORT

RADIOLOGICAL CHARACTERIZATION AND DECISION
ANALYSIS FOR THE CPP-603 BIF FILTER ROOM

Waste Programs Division

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ABSTRACT

The Waste Programs Division of EG&G Idaho, Inc., and Exxon Nuclear Idaho Company (ENICO) have completed a physical and radiological characterization of the CPP-603 BIF filter room located at the Idaho Chemical Processing Plant (ICPP). In addition, a decision analysis was performed to select the best method of decommissioning the BIF filter room.

This report describes the original as well as the existing filter system. General radiation fields inside the filter room were measured, radioisotopes were identified, and their concentrations determined. Also, contaminated waste volumes were estimated.

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RADIOLOGICAL CHARACTERIZATION AND DECISION ANALYSIS FOR THE CPP-603 BIF FILTER ROOM

1. INTRODUCTION AND BACKGROUND

The components of the BIF filter system addressed in this report are contained in a room on the east side of CPP-603 (see Figure 1). Building CPP-603 contains the Fuel Receiving and Storage Facility (FRSF) and is located near the south perimeter of the ICPP (see Figure 2). Before fuel assemblies are reprocessed in the CPP-601 area, they are stored at the FRSF until a sufficient amount of fuel is accumulated for a reprocessing run. The fuel is stored in three deep basins in CPP-603. The basins are filled with water, allowing approximately 20 feet of cover over the fuel assemblies to provide radiation shielding. The FRSF was constructed in 1951; since then, accumulations of suspended dirt and dead algae have limited the visibility of the water. This has limited the fuel transfer operations within the basins.

When the FRSF was constructed, a filtration system was installed in the room presently containing the BIF filter system. This first filtration system consisted of two tanks and a main pump. The tanks contained stones coated with diatomaceous earth. Basin water was pumped into the filter tanks where the water was clarified and subsequently returned to the basin. When the pressure drop across the filter tanks became excessive, the diatomaceous earth and the filtered solids were backwashed to CPP-301, a concrete settling vault 5 by 5 by 23 feet located adjacent to CPP-603. When the slurry settled, the supernatant was drained from the settling pit to a drywell, CPP-303, where the effluent was essentially released to the surrounding soil.

Excessively long settling times eventually led to the replacement of the vertical settling vault with a horizontal settling basin, CPP-740. This system was installed adjacent to the CPP-301 vault. In this new

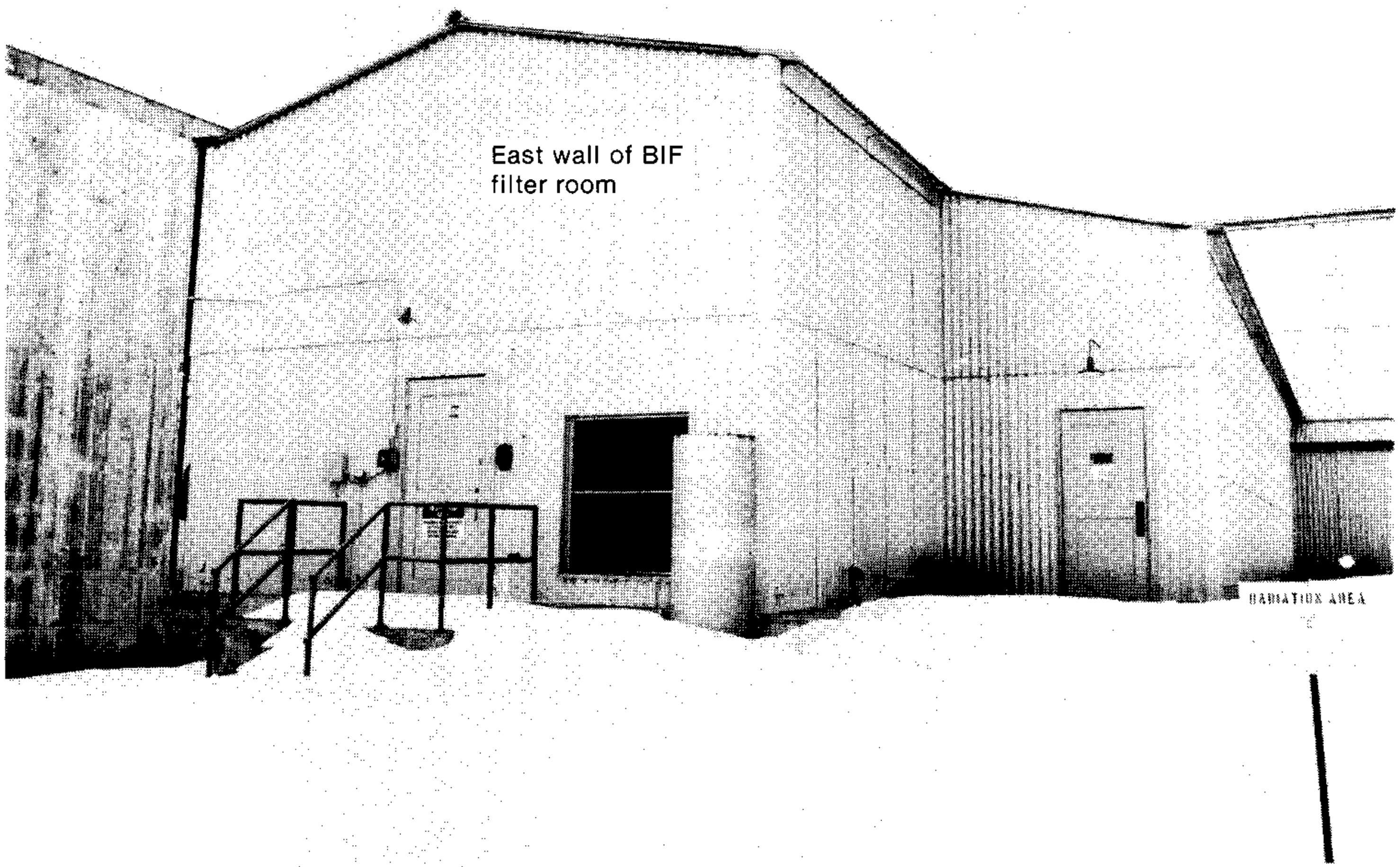

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Figure 1. CPP-603, showing the east wall of the BIF filter room.

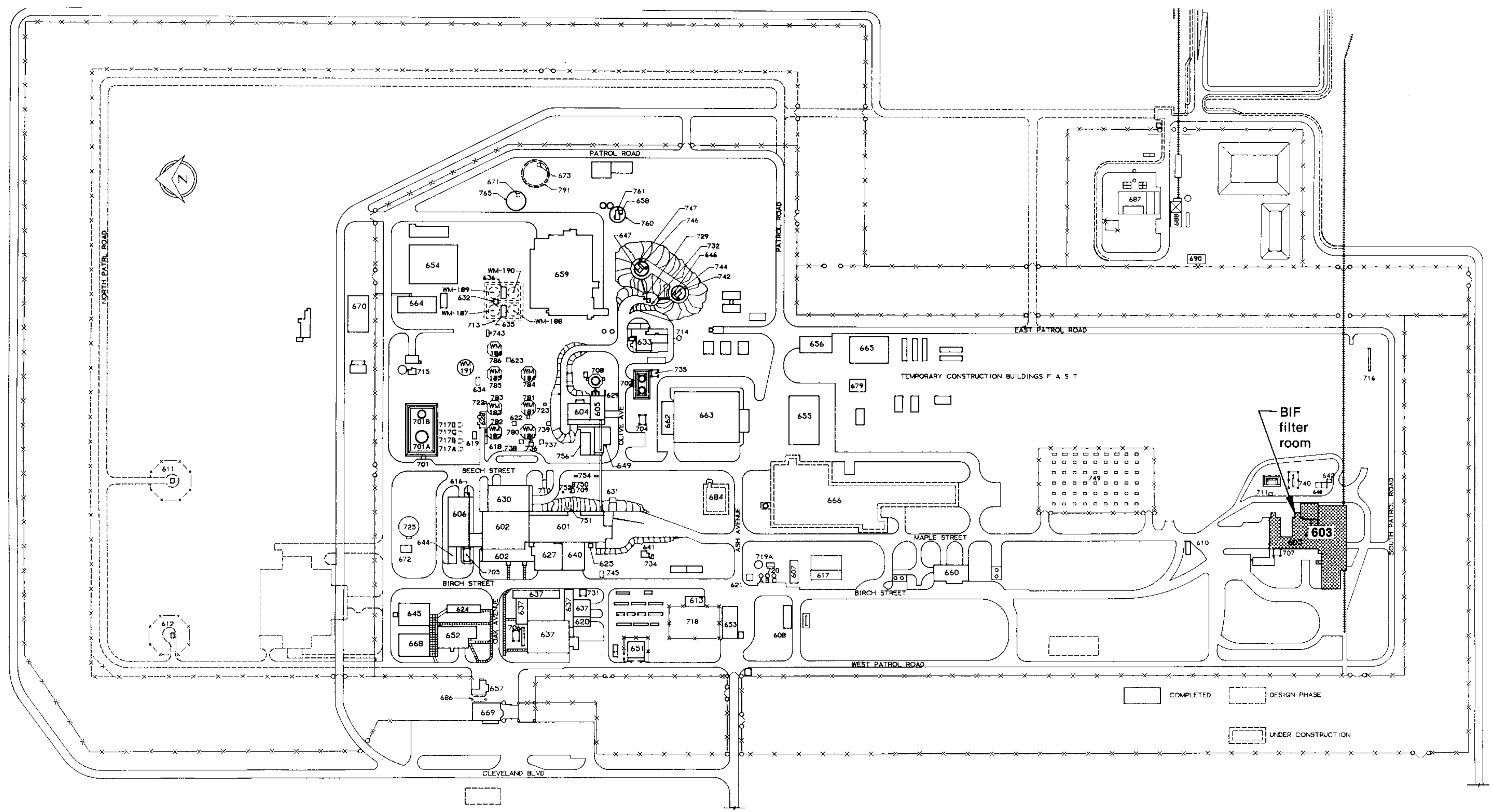

Figure 2. Plot plan of ICPP.

system, the slurry was washed over a series of weirs where the filter aid material was separated from the aqueous stream. The supernate was then drained into a well, MAH-SFE-SW-048.

The underground settling vault (CPP-301), the drywell (CPP-303), the horizontal settling basin (CPP-740), and the supernate well (MAH-SFE-SW-048) were radiologically characterized in 1981. This characterization is documented.[1] The decision analysis and D&D for these components of the system are planned for the future, but will not be addressed in this report. The part of the BIF filter system addressed in this report includes only the components in the BIF filter room located on the east side of building CPP-603.

Fuel receipts at the FRSF increased significantly during the operating years of the stone filter system. The added load on the filter exceeded its design capability and in mid-1962 the stone filters were replaced by the BIF[a] filter system.

The BIF filter system, a vacuum-type, diatomaceous earth-filtering unit, is described in Section 2. It operated from 1962 to 1966 in much the same manner as the stone filters, whereby the backwash slurries were sent to the horizontal basin and the resulting supernatant to the drywell. Beginning in 1966, the backwash slurries were transferred to underground holding tanks and the resulting supernatant to a waste evaporator.

Increases in algae growth and the subsequent increase in basin water sludge steadily placed more demand on the BIF filter. This resulted in an increased number of periodic backwashes and rapid loading of the holding tanks. In March 1969, the activity of the basin water increased following the rupturing of several EBR-II fuel canisters. A significant portion of this activity was deposited on the BIF filter elements during the following three years.

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a. BIF Division of the New York Air Brake Company, Providence, Rhode Island.

The backwash frequency of the BIF filter continued to increase as did the resulting volume of liquid waste that required evaporation and subsequent calcination. Additionally, the filter-washing effort involved hosing and scrubbing to remove the contaminated diatomaceous earth, and resulted in 50 to 80 mR exposure per person during each filter washing.

For these reasons, a search for a better filtration system began. Finally, in 1977, a new pressurized sand filtration unit was activated in a room adjacent to the BIF filter room; the BIF filter, after 15 years of operation, was taken off line. The new sand system continues to serve the basins to date.

2. BIF FILTER ROOM DESCRIPTION

The BIF filter room is located on the east side of CPP-603 (Figure 1). A plan view showing the room dimensions and the layout of major components is shown in Figure 3. The room walls are constructed of corrugated steel and are approximately 15 ft high; the floor is concrete. The south wall joins the concrete wall of the pressurized sand-filtration room. The west wall joins the middle fuel storage basin in CPP-603.

An isometric of the BIF filter system is shown in Figure 4. The filter system basically consisted of a filter compartment containing filter elements, and associated piping, pumps, and valves. These filter elements are hollow, rigid, porous, fiberglass-reinforced plastic. They are covered with a fine-mesh polyethylene or nylon sleeve. The outside surface of each filter element was coated with diatomaceous earth, which acted as a filter-aid material.

The diatomaceous earth was mixed with water in the precoat tank, also shown in Figure 4. A high-speed mixer was used to suspend the diatomaceous earth. The slurry was then pumped into the BIF filter compartment. Deposition of the diatomaceous earth required filling the filter compartment with water and recirculating the solution by using the recycle line and the appropriate valves shown in Figure 4. Once deposition of diatomoceous earth was complete, water from the fuel-storage basin was circulated through the BIF filter.

After water was circulated from the basin through the BIF filter for about 12 hours, the pressure drop across the filter became excessive and the system was shut down in order to clean the filter elements. The filter compartment was drained, and the diatomaceous earth was washed from each filter element. The radioactive slurry was drained to the underground facility adjacent to CPP-603. The filtering process was then repeated.

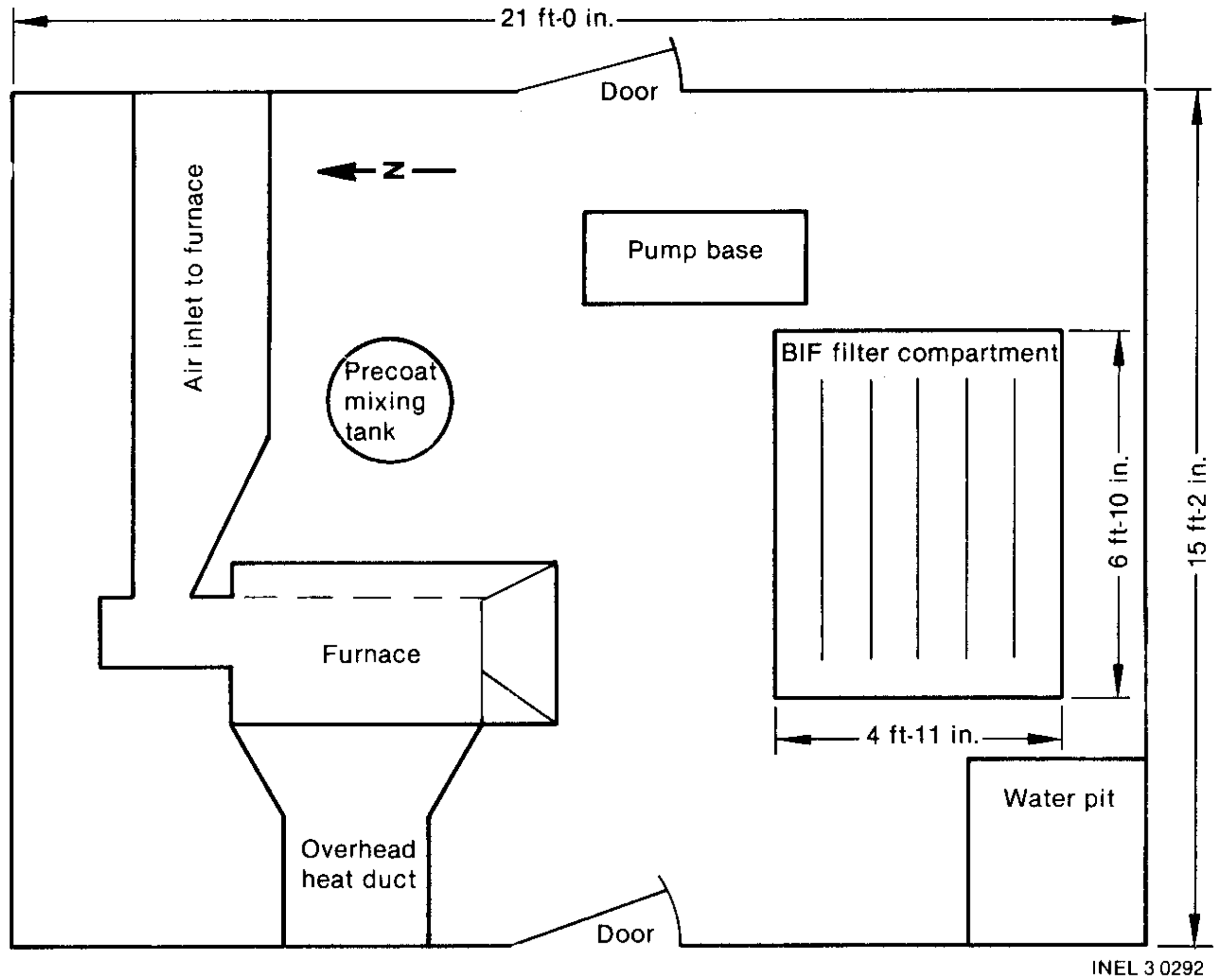

Figure 3. Plan view of the CPP-603 BIF filter room.

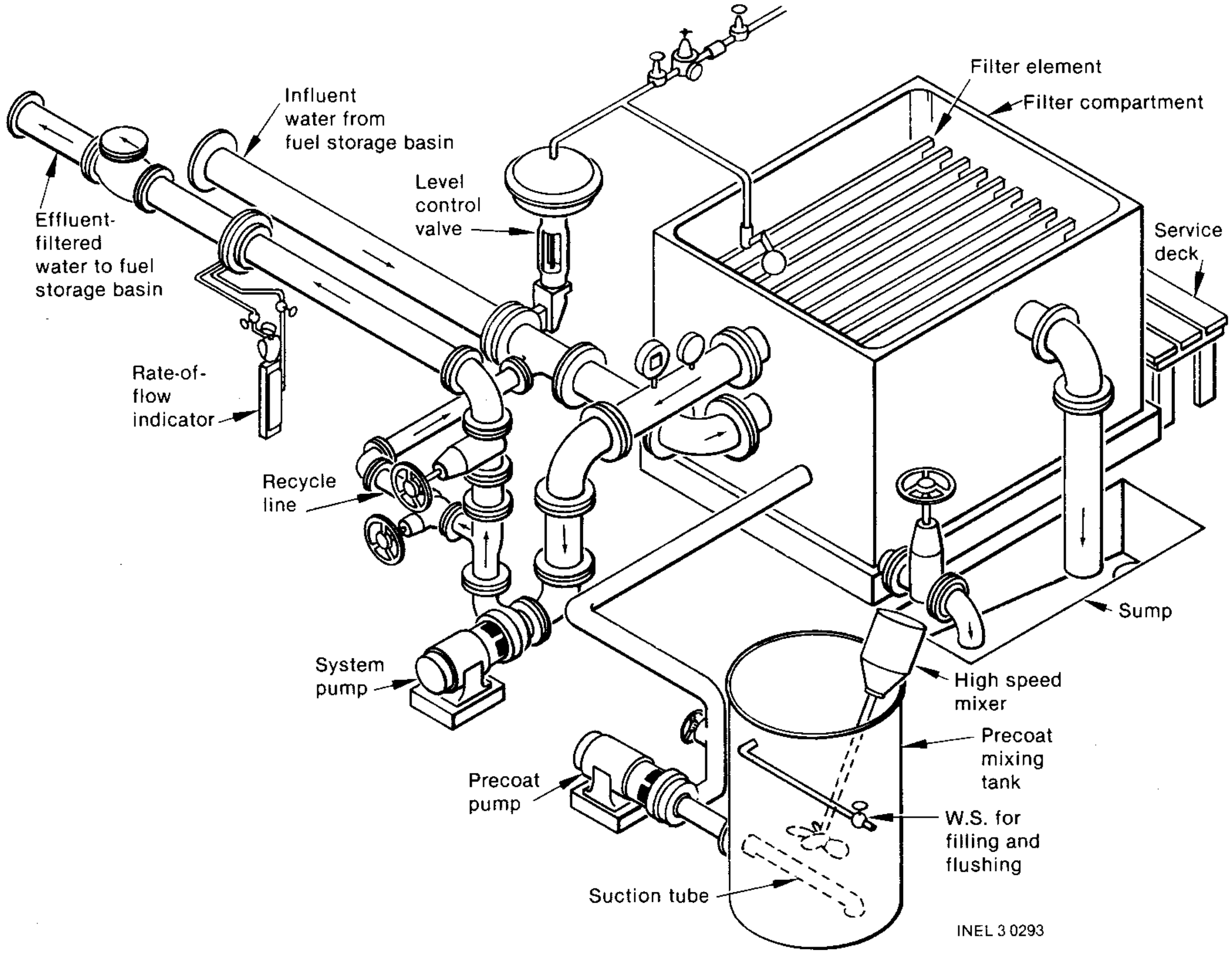

Figure 4. BIF filter system.

Figures 5 through 13 show the inside of the BIF filter room. The furnace shown in Figure 10 has not been in operation for several years. Originally it supplied heat to the middle fuel-storage basin in CPP-603 as well as to the BIF filter room.

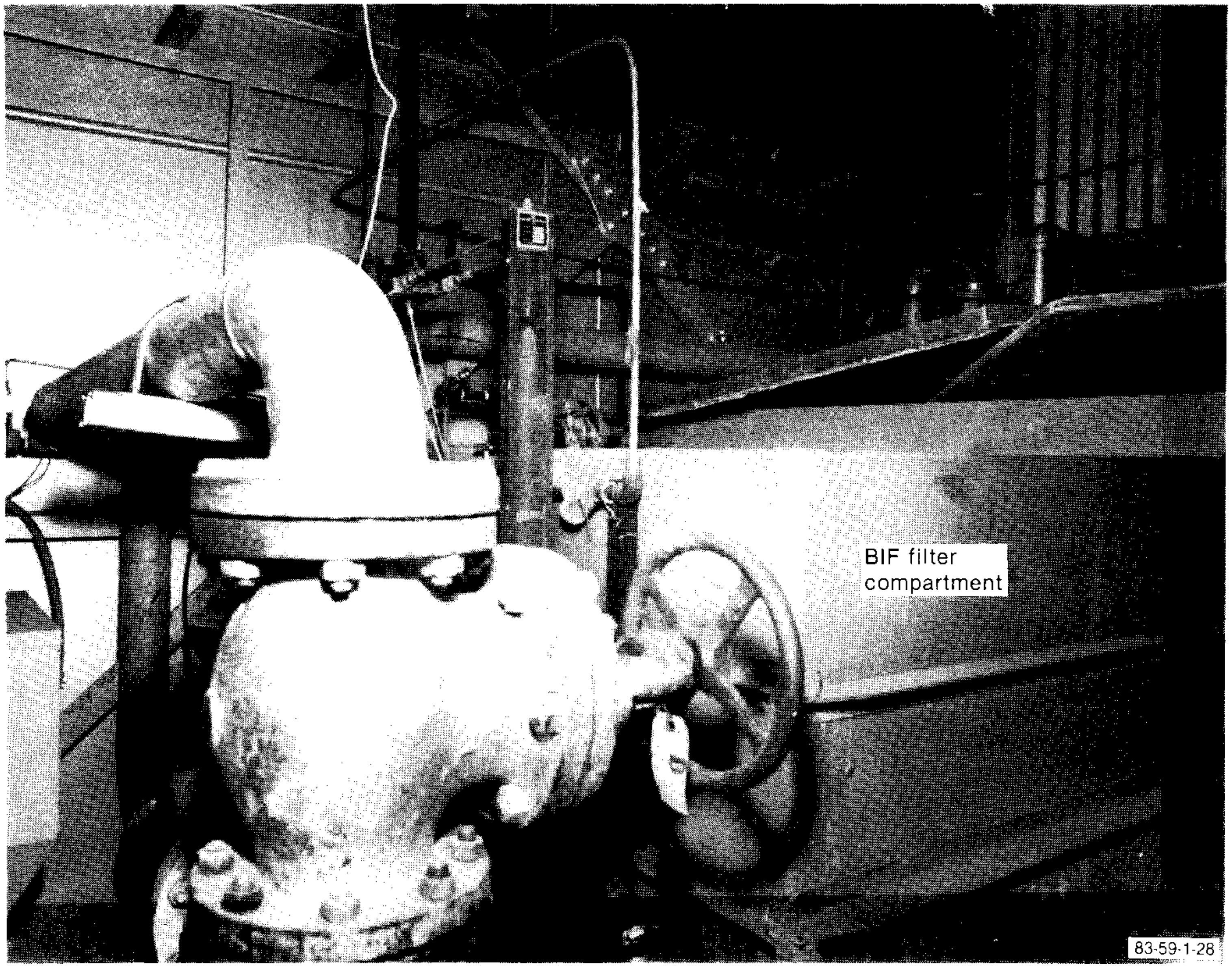

Figure 5. BIF filter room, looking toward the southwest corner.

Figure 6. Inside BIF filter compartment.

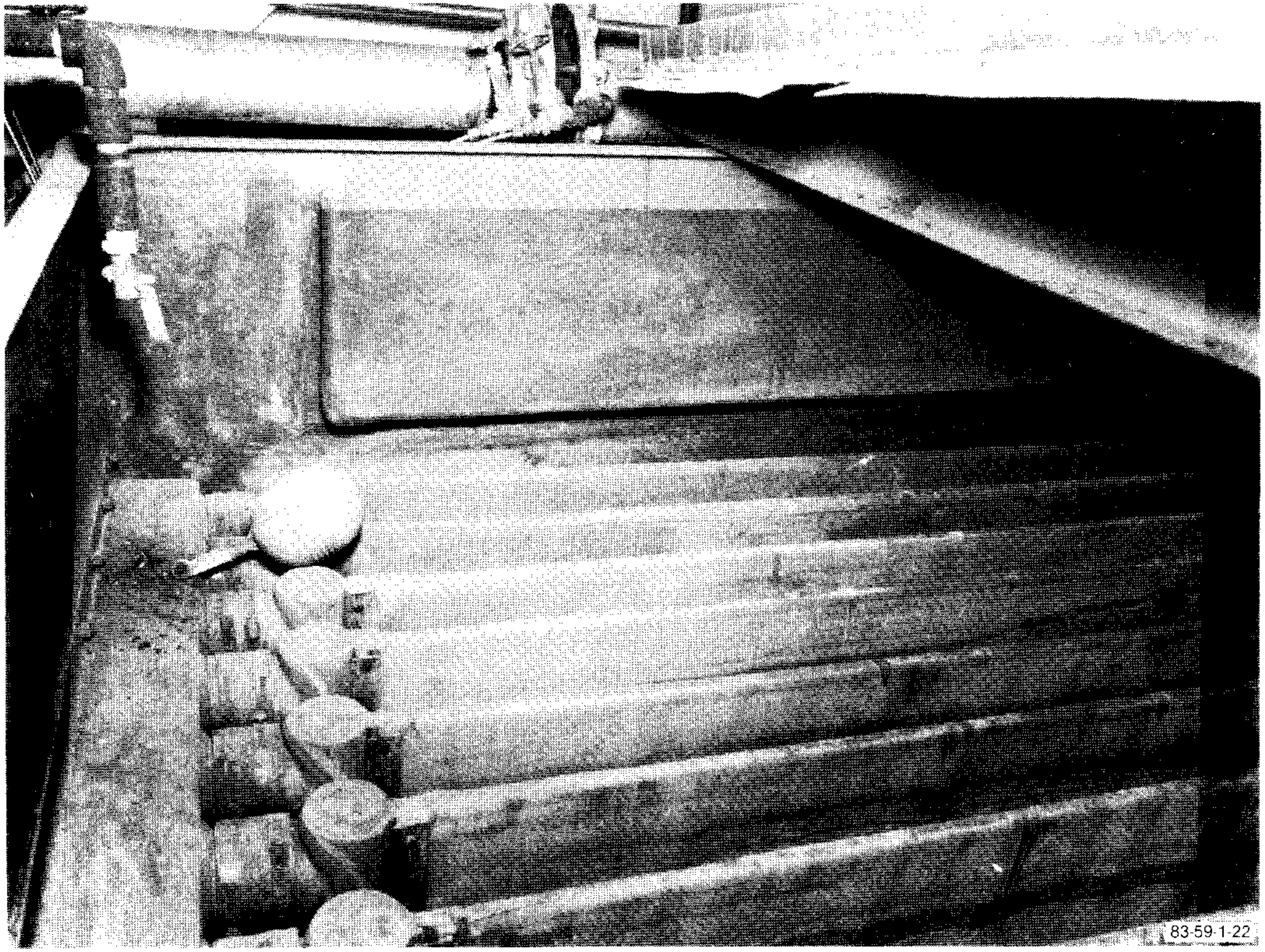

Figure 7. Inside BIF filter compartment, looking north.

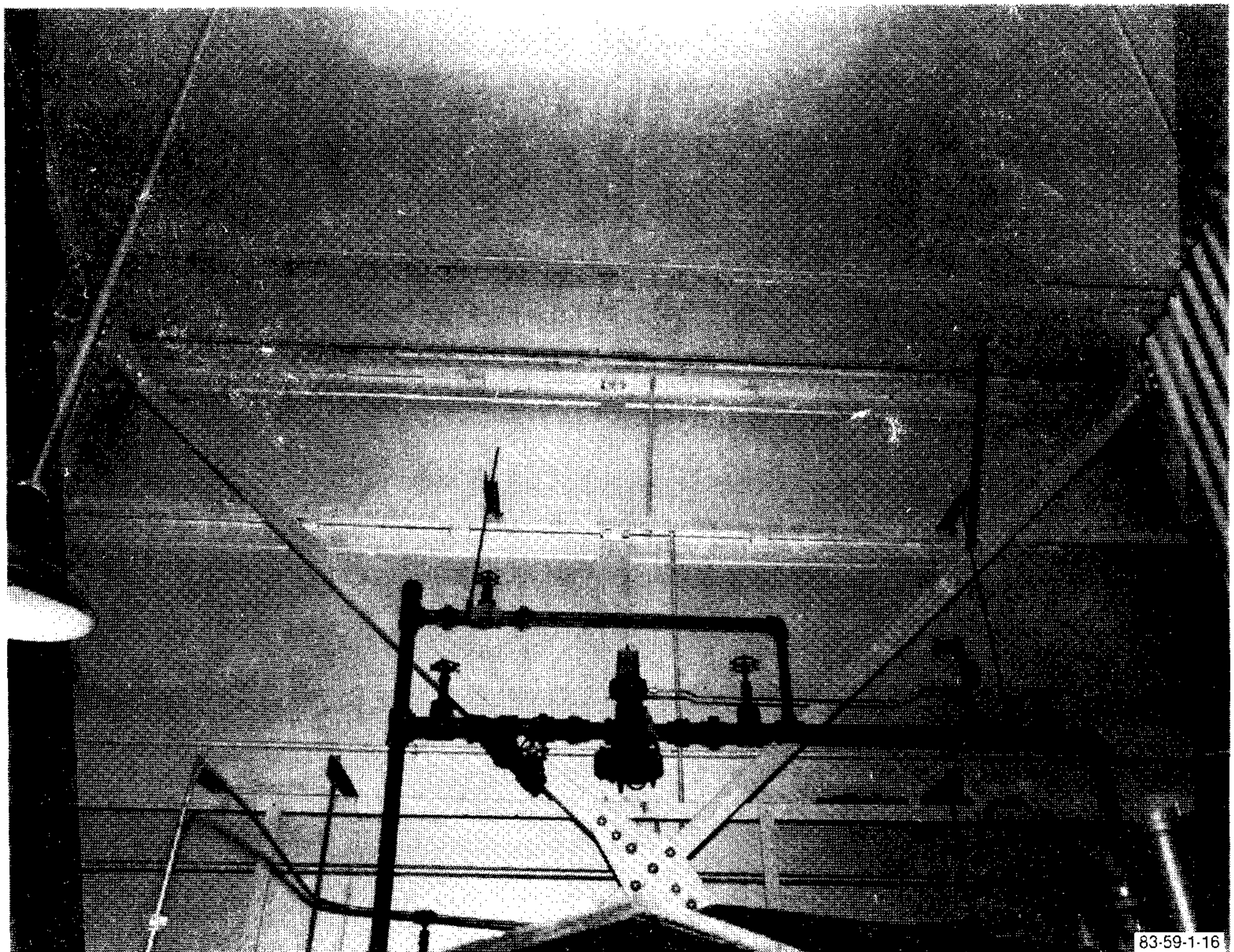

Figure 8. BIF filter room, looking at upper south wall.

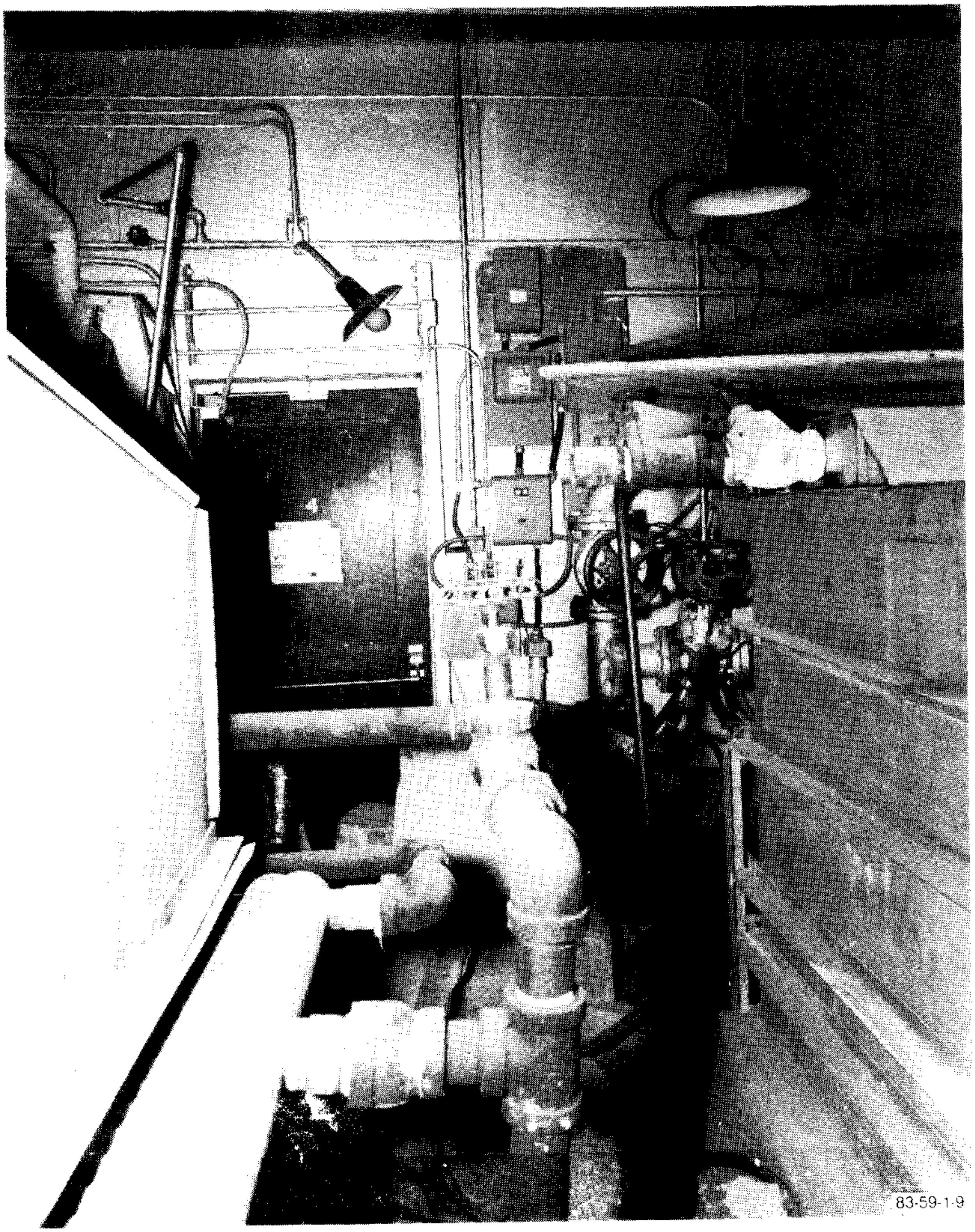

Figure 9. View from west center, looking toward east door.

Figure 10. View from pump base toward northwest corner.

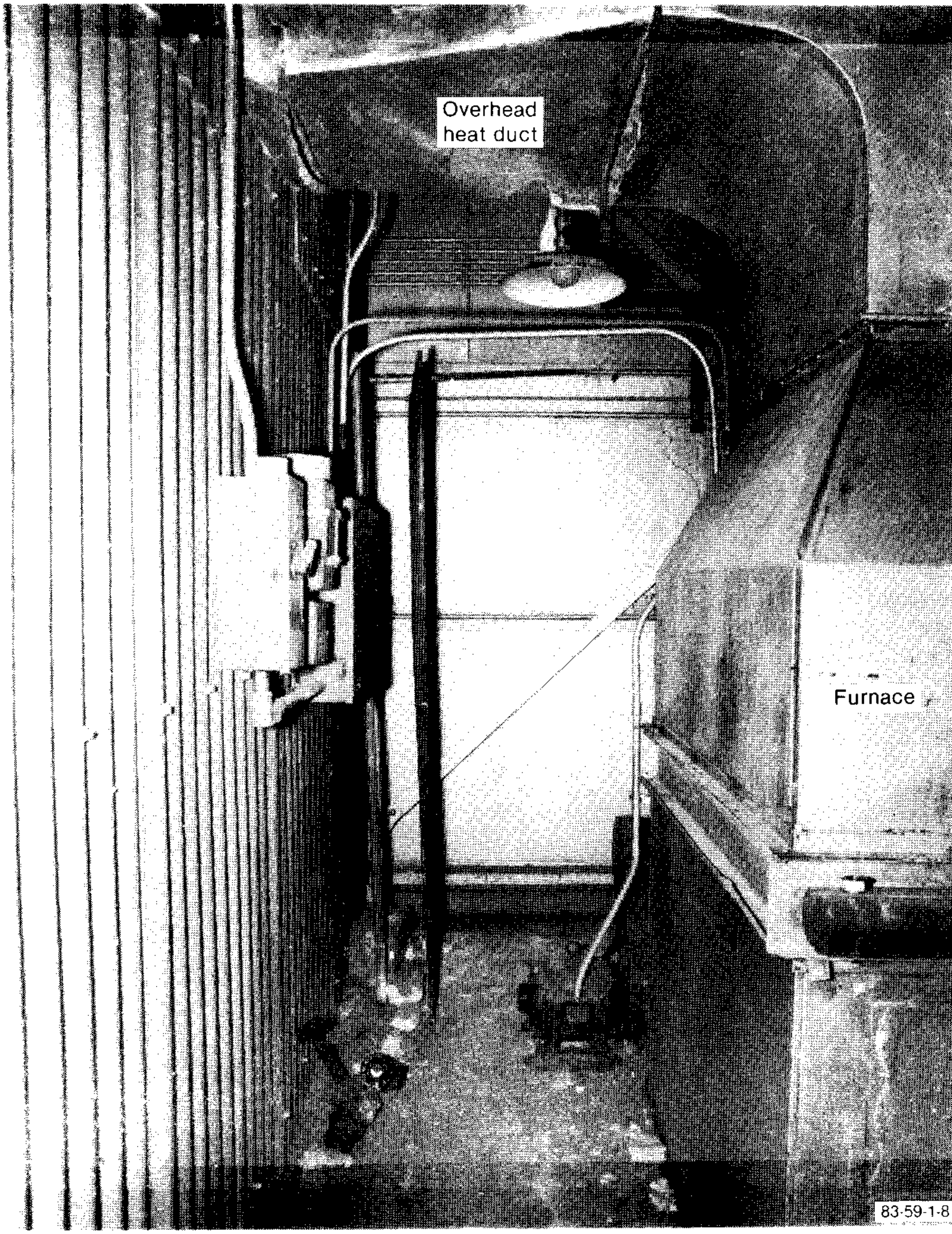

Figure 11. View along west wall toward northwest corner.

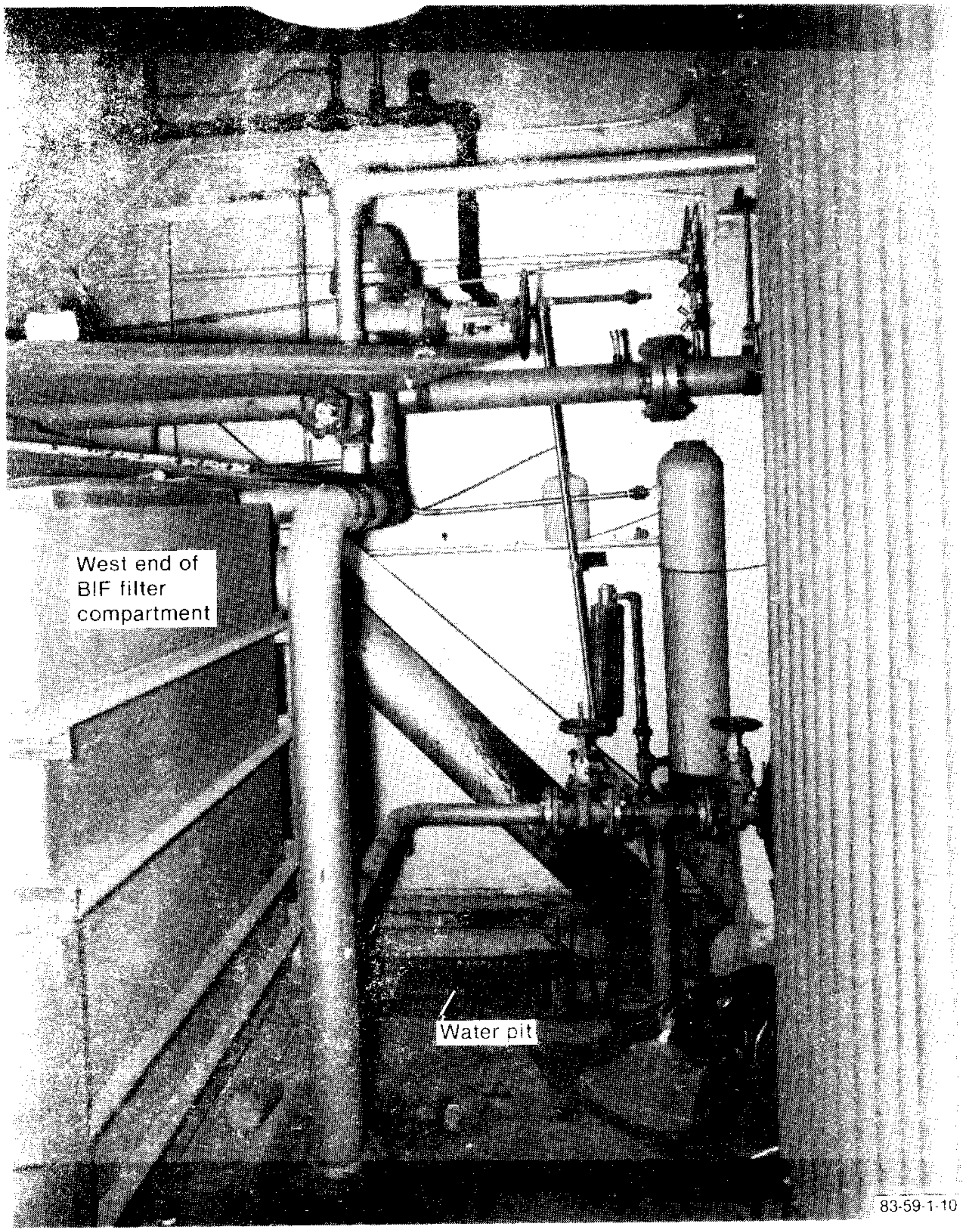

Figure 12. View along west wall toward southwest corner.

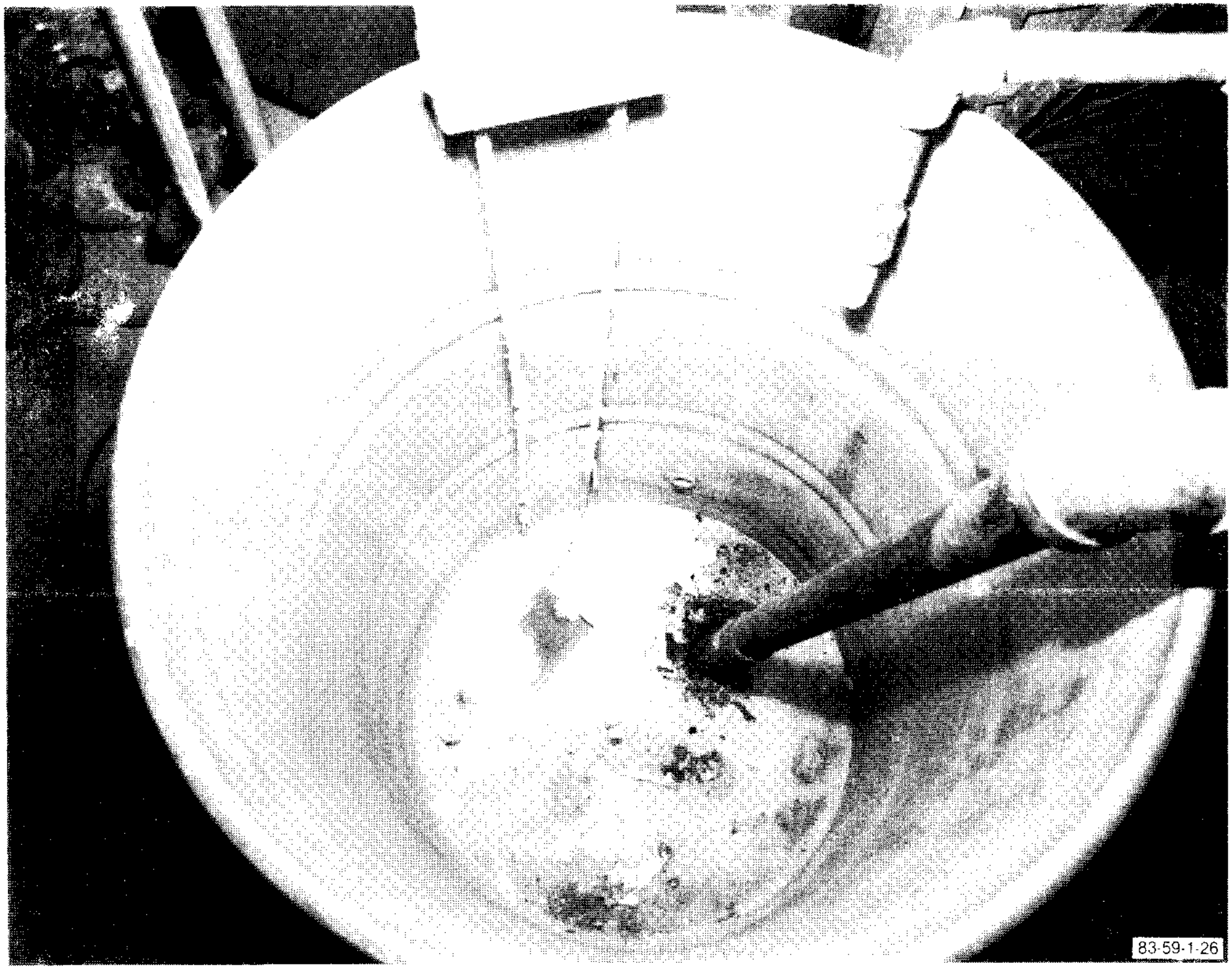

Figure 13. Precoat mixing tank.

3. CHARACTERIZATION PERFORMED AND RESULTS

3.1 Radiation Survey

Radiation fields were measured at several locations within the BIF filter room. The radiation fields and the location of each measurement are shown in Figure 14. The radiation fields ranged from 100 mR/h β γ 3 ft above the floor at locations shown in Figure 14 to 2 R/h β γ in the water pit and on the floor in the southeast corner of the room.

3.2 Radioisotopic Analysis

Several samples of materials, including concrete, diatomaceous earth, rust, and nylon mesh, were taken at various locations within the BIF filter room. Each sample was numbered and sent to the ENICO Analytical Laboratory for isotopic analysis by gamma spectrometry. The sample number, origin, and material for all the samples are listed in Table 1. Results of the gamma spectrum analysis are shown in Table 2. In addition to the gamma analysis, three of the samples were designated for ^{90}Sr, Pu, and U analysis. Results of that analysis were incomplete, with data for only ^{90}Sr and Pu available for sample number 2, and the other samples being lost during sample dissolution. Results of a second analysis are shown in Table 3.

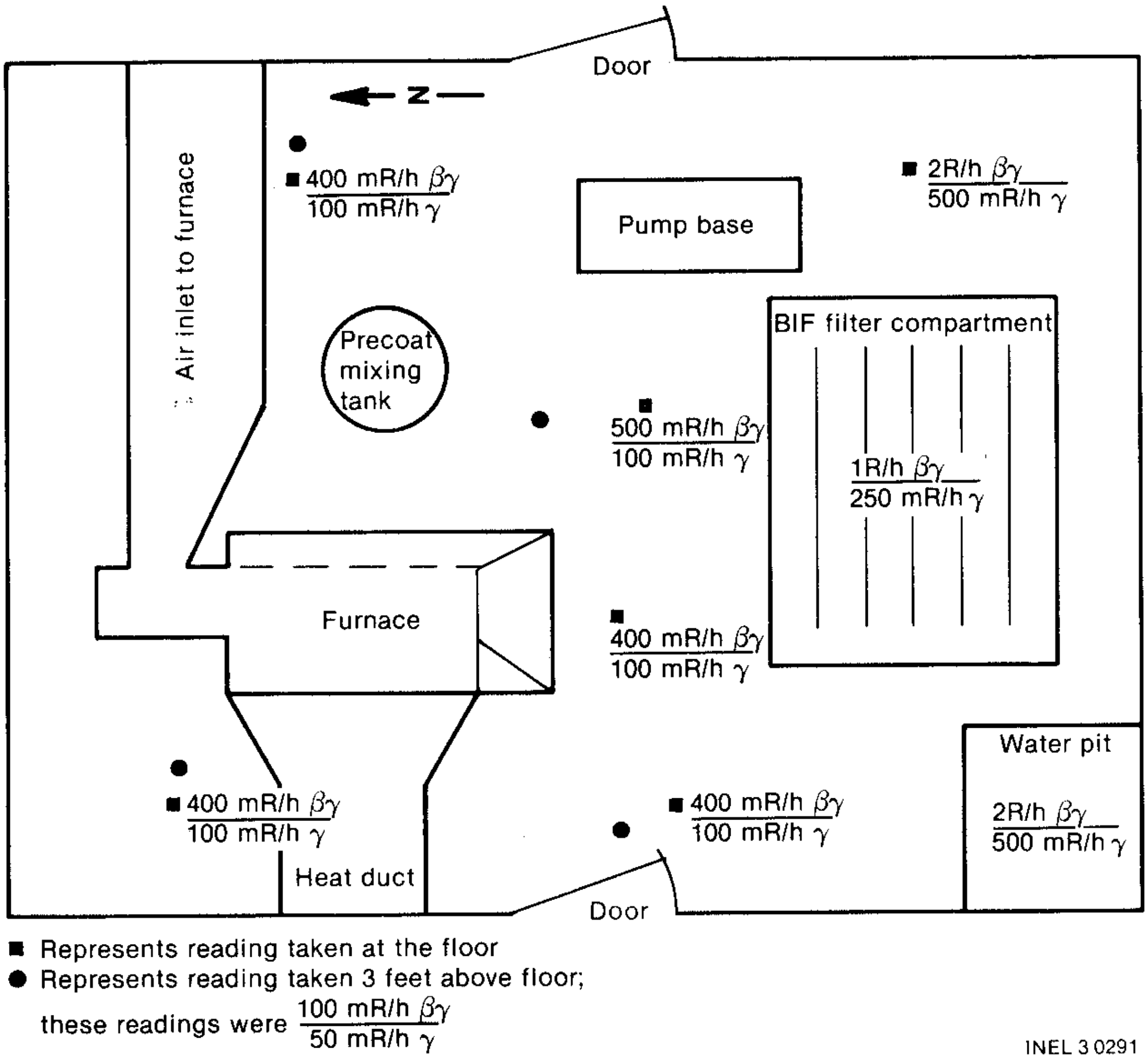

Figure 14. Radiation readings in BIF filter room.

TABLE 1. BIF FILTER ROOM SAMPLE LOCATION AND MATERIAL

Identification Number	Location	Material
1	North side mixing tank	Diatomaceous earth
2	BIF filter compartment, center bottom	Diatomaceous earth
3	BIF filter compartment, west side	Nylon mesh
4	BIF filter compartment, northeast corner	Diatomaceous earth
5	Floor, northwest corner	Dust, dirt, diatomaceous earth
6	BIF filter compartment intake manifold, top center	Diatomaceous earth and dust
7	Main pump floor scrapings	Concrete and dirt
8	BIF filter compartment discharge, top	Diatomaceous earth
9	Discharge pipe, near pit	Rust
10	Discharge pipe, near pit	Rust
11	BIF filter compartment, top west end	Diatomaceous earth
12	BIF filter compartment, bottom southwest corner	Diatomaceous earth
13	BIF filter compartment, east end	Nylon mesh
14	Pump base	Concrete
15	BIF filter compartment, northeast corner	Nylon mesh

TABLE 2. RADIOISOTOPIC CONCENTRATION OF SAMPLES TAKEN FROM THE BIF FILTER ROOM (pCi/g)

Identification Number[a]	^{144}Ce	^{60}Co	^{134}Cs	^{137}Cs	^{152}Eu	^{154}Eu	^{155}Eu	^{40}K	^{106}Ru	^{125}Sb
1	--b	8.80×10^{1}	2.42×10^{2}	3.51×10^{4}	4.18×10^{2}	3.14×10^{2}	1.61×10^{2}	1.04×10^{3}	--b	--b
2	4.37×10^{6}	1.82×10^{5}	--b	1.53×10^{6}	6.52×10^{6}	5.05×10^{6}	2.26×10^{6}	--b	--b	1.10×10^{5}
3	4.64×10^{5}	1.80×10^{3}	--b	1.26×10^{5}	6.91×10^{5}	5.27×10^{5}	2.66×10^{5}	--b	1.12×10^{4}	1.59×10^{6}
4	9.68×10^{5}	1.04×10^{5}	1.98×10^{4}	2.10×10^{6}	1.65×10^{6}	1.25×10^{6}	6.05×10^{5}	--b	--b	5.07×10^{4}
5	--b	1.56×10^{2}	2.10×10^{3}	2.31×10^{5}	7.65×10^{2}	1.04×10^{3}	--b	--b	--b	--b
6	8.18×10^{4}	1.83×10^{4}	1.78×10^{5}	2.25×10^{7}	1.86×10^{5}	1.60×10^{5}	6.70×10^{4}	--b	--b	--b
7	1.36×10^{5}	3.59×10^{4}	2.61×10^{4}	3.21×10^{6}	2.44×10^{5}	2.02×10^{5}	7.63×10^{4}	1.03×10^{4}	--b	2.54×10^{4}
8	4.47×10^{6}	1.12×10^{6}	6.23×10^{4}	6.45×10^{6}	5.27×10^{6}	4.30×10^{6}	2.15×10^{6}	--b	2.65×10^{5}	4.05×10^{5}
9	--b	1.47×10^{4}	2.25×10^{4}	3.04×10^{6}	1.60×10^{5}	1.60×10^{6}	3.65×10^{4}	--b	--b	2.49×10^{4}
10	--b	3.39×10^{3}	8.75×10^{3}	1.16×10^{6}	1.56×10^{4}	1.28×10^{4}	3.68×10^{3}	--b	--b	--b
11	2.32×10^{6}	1.50×10^{5}	1.76×10^{4}	1.96×10^{6}	3.37×10^{6}	2.67×10^{6}	1.14×10^{6}	--b	--b	6.68×10^{4}
12	2.48×10^{6}	1.89×10^{5}	3.10×10^{4}	1.80×10^{6}	3.64×10^{6}	2.82×10^{6}	1.25×10^{6}	--b	--b	8.64×10^{4}
13	7.71×10^{5}	2.56×10^{4}	--b	1.58×10^{5}	8.35×10^{5}	6.31×10^{5}	2.97×10^{5}	--b	--b	2.25×10^{4}
14	--b	8.39×10^{3}	--b	2.79×10^{3}	3.46×10^{5}	1.97×10^{3}	1.80×10^{3}	4.64×10^{3}	--b	--b
15	7.48×10^{5}	4.14×10^{4}	2.98×10^{3}	1.85×10^{5}	9.96×10^{5}	7.89×10^{5}	3.56×10^{5}	--b	1.57×10^{4}	--b

a. Location of each sample is given in Table 1.

b. Isotopes not detected.

TABLE 3. ANALYSIS RESULTS FOR U, Pu, AND ^{90}Sr IN THREE SAMPLES FROM BIF FILTER ROOM (pCi/g)

Sample Number	U	^{238}Pu	^{239,240}Pu	^{90}Sr
2	223	1.59×10^3	2.66×10^3	3.95×10^7
10	<12.5	4.95×10^3	1.10×10^3	9.4×10^5
12	77.8	1.60×10^3	4.00×10^3	4.1×10^5

4. POTENTIAL PROBLEM AREAS

Two potential problem areas are associated with the decommissioning of the BIF filter room:

1. The contamination is very loose and may become airborne. Care must be taken to contain the airborne contamination.

2. The steam pipes associated with the furnace (Figure 10) are covered with asbestos. Asbestos-handling practices that must be exercised during removal of these steam pipes include use of respirators and protective clothing to minimize health hazards.

5. DECISION ANALYSIS

5.1 Objective of Decision Analysis

The objective of this decision analysis was to determine and recommend the optimum method for decommissioning the CPP-603 BIF filter room. Several alternatives were considered and compared in light of established project objectives.

5.2 Project Objectives

The objectives of decommissioning the CPP-603 BIF filter room are to:

1. Reduce the radiation field hazard caused by the contamination inside the room

2. Reduce the risk of spreading radioactive contamination to occupied areas or outside the building

3. Convert the room to a reusable condition if possible

4. Perform the decommissioning in a safe and cost-effective manner

5. After completion of the decommissioning, be able to remove the CPP-603 BIF filter room from the DOE list of contaminated surplus facilities.

5.3 Alternatives

Five alternatives for decommissioning the BIF filter room were considered in this decision analysis. The "do nothing" alternative is not a decommissioning method and does not satisfy the project objectives. However, it was included as an alternative to show the consequences of doing nothing to the CPP-603 BIF filter room. The alternatives considered were:

1. "Do nothing"--The facility would be left intact in its present condition.

2. "Shield and seal" --This alternative includes two options: For Option 1, high-radiation areas would be shielded after completion of a general decontamination. All equipment and structural surfaces would be treated with a contamination fixant. For Option 2, the walls of the filter room would be reinforced and the room filled with concrete.

3. "Decon"--All equipment and structural surfaces would be decontaminated to safe levels.

4. "Partial removal and decon"--All equipment would be removed from the filter room and the remaining structure decontaminated.

5. "Total removal"--all equipment and structures would be removed, boxed, and buried at the RWMC. The structure removal would consist of removing the south, north, and east walls, the roof, and the concrete floor. The west wall would be decontaminated and left in place because it is part of the adjacent building.

5.4 Approximate Cost of Each Alternative

The estimated cost to perform the decommissioning is shown in Table 4 for each alternative. The estimates include labor and material costs based on FY 1983 rates. In addition, the estimates include dollar costs for additional workers. These costs are necessary since the first increment of workers will likely reach their maximum daily dose early in the day. The cost for radiation exposure in these estimates is $2,000 per man-rem, based on the average cost for radiation-related work at the ICPP.

TABLE 4. DECOMMISSIONING COST ESTIMATES

Alternative	Estimated Cost ($000)
1. Do nothing	0
2. Shield and seal	
Option 1	40
Option 2	37
3. Decon	400
4. Partial removal and decon	126
5. Total removal	113

5.5 Material Reuse

A very low potential exists for the reuse of any BIF filter room equipment, except possibly with the "decon" alternative. However, the decontamination cost would exceed replacement cost because of the great amount of contamination and relative low dollar cost of the equipment.

5.6 Building Reuse

Reuse possibilities for the BIF filter room following each alternative are listed below.

1. Do nothing--Possible use for storage of contaminated items; however, this use would be very limited because of existing high radiation fields and the limited available space.

2. Shield and seal--Option 1 would offer possible use for storage, but the shielding would reduce the available space. Option 2 would offer no possibility of building reuse.

3. Decon--After "decon", equipment could be removed, making the room available for storage.

4. Partial removal and decon--Following implementation of this alternative, the BIF filter room would be available for storage or any other purpose.

5. Total removal--The room would not exist after "total removal"; however, the real estate would be available for additions to the adjacent buildings.

5.7 Surveillance and Maintenance Costs

Estimated surveillance and maintenance costs are given in Table 5. Surveillance and maintenance costs are experienced only if the radioactivity is left in the filter room.

TABLE 5. SURVEILLANCE AND MAINTENANCE COSTS

Alternative	Surveillance Labor ($000)	Surveillance Radiation Exposure ($000)	Maintenance ($000)	Total ($000)
1. Do nothing	192[a]	256[b]	100[c]	548
2. Shield and seal				
Option 1	192[a]	0	100[c]	292
Option 2	192[a]	0	100[c]	292
3. Decon	0	0	0	0
4. Partial removal and decon	0	0	0	0
5. Total removal	0	0	0	0

a. Based on 400-year decay time, 2 man-days/year, $30/h.

b. Based on a calculated 20 mR/h average radiation field during 400-yr decay, 2 man-days/yr, and $2000/man-rem.

c. Assuming the entire building is replaced during decay.

5.8 Volume of Waste Generated

The estimated radioactive waste volume generated for each alternative is given in Table 6.

5.9 Radiation Exposure to Involved Workers

The estimated radiation exposures during decommissioning for each alternative are summarized in Table 7.

5.10 Short-term Impact on INEL Personnel and Operations

The short-term impact for each alternative is summarized in Table 8.

5.11 Long-term Impact to Public

The long-term impact to the public is summarized in Table 9 for each alternative.

5.12 Advantages and Disadvantages of Each Alternative

The advantages and disadvantages of each alternative are listed in Table 10.

5.13 Cost-Benefit Summary

1. The do nothing alternative has no decommissioning costs, but high surveillance and maintenance costs. It does not satisfy the project objectives of reducing risk of contamination spread, allowing reuse of building, or removing the facility from DOE's list of contaminated surplus facilities.

2. Shield and seal has low decommissioning costs, but high surveillance and maintenance costs. This alternative does reduce the potential for contaminating the middle basin and adjacent

TABLE 6. ESTIMATED WASTE VOLUME GENERATED

Alternative	Boxed Volume (ft^3)	Boxes: Size (ft)	Boxes: Total
1. Do nothing	0	0	0
2. Shield and seal			
Option 1	64[a]	2 x 4 x 8	1
Option 2	64[a]	2 x 4 x 8	1
3. Decon	192[b]	4 x 4 x 8-ft 2 x 4 x 8-ft	1 1
4. Partial removal and decon	608[b,c]	2 x 4 x 8-ft 4 x 4 x 8-ft 6 x 6 x 8-ft	1 2 1
5. Total removal	1200[d]	2 x 4 x 8-ft 6 x 6 x 8-ft 4 x 4 x 8-ft	6 1 4

a. Waste volume consists of miscellaneous loose debris.

b. Assumes decontamination of concrete floor does not require removal of more than 2 in. of concrete.

c. Assumes furnace can be cut and placed in standard boxes. The BIF filter compartment will be packaged intact in a nonstandard-size box (6 x 6 x 8-ft).

d. This volume includes 400 ft^3 of concrete, allowing for 25% void volume.

TABLE 7. RADIATION EXPOSURES TO INVOLVED WORKERS

Alternative	Estimated Exposures (man-rem)
1. Do nothing	0
2. Shield and seal	
Option 1	8.4
Option 2	2
3. Decon	132
4. Partial removal and decon	24
5. Total removal	20

TABLE 8. SHORT-TERM IMPACT ON INEL PERSONNEL AND OPERATIONS

Alternative	Short-term Impact
1. Do nothing	Potential for contaminating middle basin and adjacent areas Potential radiation hazard
2. Shield and seal	
Option 1	Small potential for contaminating basin
Option 2	None
3. Decon	Large liquid waste volume generated during decontamination
4. Partial removal and decon	Small liquid waste volume generated during decontamination
5. Total removal	None

TABLE 9. LONG-TERM IMPACT TO PUBLIC

Alternative	Long-term Impact
1. Do nothing	Remedial action required if CPP is returned to public domain
2. Shield and seal Options 1 and 2	Very costly remedial action required if CPP is returned to public domain, especially for Option 2
3. Decon	None at CPP. Insignificant increase in waste volume at RWMC
4. Partial removal and decon	Same as 3
5. Total removal	Same as 3

TABLE 10. ADVANTAGES AND DISADVANTAGES

Alternative	Advantages	Disadvantages
1. Do nothing	No decommissioning costs. No waste to RWMC.	High potential for contamination spread. Loss of real estate. Highest surveillance and maintenance costs. Future remedial action probable.
2. Shield and seal	Radiation fields insignificant. Potential for contamination reduced.	Loss of real estate. High surveillance and maintenance costs.
3. Decon	Room available for reuse. Potential for contamination eliminated. Low surveillance and maintenance costs. Radiation fields eliminated.	Very high decommissioning costs. Radiation exposure high during decommissioning. Limited space available in room.
4. Partial removal and decon	Room available for reuse. Potential for contamination eliminated. Radiation fields eliminated. Low surveillance and maintenance costs.	High decommissioning costs.
5. Total removal	Real estate available for reuse. Potential for contamination eliminated. Radiation fields eliminated. Low surveillance and maintenance costs.	High decommissioning costs. Room not available.

areas but does not eliminate that potential. Reduction in radiation fields and limited use of the building for storage are associated with this alternative. The facility, however, would not be removed from DOE's list of contaminated surplus facilities.

3. The decon alternative has very high decommissioning costs but no surveillance and maintenance costs. The potential for contaminating the middle basin and adjacent areas, and the existing radiation fields would be eliminated. This alternative would permit unlimited use of the building and its removal from DOE's list of contaminated facilities, if the decontamination is successful.

4. "Partial removal and decon" has high decommissioning costs, but no surveillance and maintenance costs. The potential for contaminating the middle basin would be eliminated. This alternative would permit unlimited use of the building if the decontamination is successful. The facility could then be removed from DOE's list of contaminated surplus facilities.

5. "Total removal" has high decommissioning costs but no surveillance and maintenance costs. The potential for contaminating the middle basin would be eliminated. This alternative would allow reuse of the real estate but not the BIF filter room. The facility could be removed from DOE's list of contaminated surplus facilities.

5.14 Recommendation

Alternative 4, partial removal and decon, is recommended to be used in the decommissioning of the BIF filter room. It offers the most benefits with fewer disadvantages and uncertainties.

6. WASTE VOLUME ESTIMATE

The estimated waste volume for the recommended decommissioning method is summarized in Table 11.

TABLE 11. ESTIMATED WASTE VOLUME FROM PARTIAL REMOVAL AND DECON

Components	Principal Material	Boxed Volume (ft^3)	Boxes: Size (ft)	Boxes: Total	Melted Volume (ft^3)
BIF filter compartment	Carbon steel, fiberglass, and plastic	288[a]	6 x 6 x 8	1	NA
Motors, pumps, and valves	Carbon steel and copper	38	4 x 4 x 8	3	1.8
Piping and precoat mixing tank	Carbon steel	50	4 x 4 x 8	4	2.4
Furnace and ducting	Carbon steel	40	4 x 4 x 8	3	2.0
Concrete floor[b]	Concrete	64	2 x 4 x 8	1	NA
Miscellaneous metal	Lead, steel, and aluminum	64	4 x 4 x 8	5	1.5
Miscellaneous combustibles	Wood	64	4 x 4 x 8	5	NA
Total		608	6 x 6 x 8 4 x 4 x 8 2 x 4 x 8	1 2 1	7.7

a. The BIF filter compartment, because of its gross contamination and associated high radiation fields, will be boxed intact in a nonstandard box.

b. The estimated volume of concrete assumes decontamination of the concrete floor can be accomplished by spalling no more than 2 in. from the surface.

7. DRAWING LIST

Drawing Title	Drawing Number
CPP-603 Vacuum Filter Foundation Details	200 0603 51 400 054427
CPP-603 Vacuum Filter Installation	200 0603 51 400 054411
CPP-603 Filter Piping	200 0603 50 400 156123
CPP-603 Heating and Ventilation Equipment Room	200 0603 20 231 103043
CPP-603 Proposed Diatomite Filter Replacement Piping	200 0603 51 706 054186
CPP-603 Proposed Rip-Out of Existing Diatomite Filter Plan	200 0603 51 706 054188

8. REFERENCE

1. J. O. Low, Radioactive Waste Characterization of CPP-603 Cleanup Basin System--CPP-740, WM-F1-81-023, Rev. 1, May 1982.